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Indian Standard
METHOD FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO ARTIFICIAL LIGHT (XENON LAMP)

(First Revision)

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Indian Standard

METHODS FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO ARTIFICIAL LIGHT (XENON LAMP)

(First Revision)

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Indian Standard

METHODS FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO ARTIFICIAL LIGHT (XENON LAMP)

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 November 1985, after the draft finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was first published in 1967 and has been revised to include changes carried out in other similar colour fastness standards regarding sampling, specimen size, apparatus and to align it with ISO 105 — BO 2-1981 Textiles — Test for colour fastness to light : Xenon arc, issued by International Organization for Standardization.

0.3 Colour fastness of textile materials to daylight is of considerable importance to the consumer. As the daylight exposure takes long time to complete a test, a quick method of determining colour fastness to light is by the use of artificial light (xenon lamp). However, there are cases where the results obtained by artificial light exposure differ from the results obtained with daylight exposure. In case of dispute, method prescribed in IS : 686-1985* should be used.

0.4 Two methods for mounting and testing of specimens for colour fastness to artificial light have been prescribed in this standard. Method 1 is considered preferable and should be used in cases of dispute. But it requires one set of standard patterns for each test specimen and is, therefore, impracticable when a large number of test specimens have to be tested concurrently. Method 2 enables a number of test specimens of differing light fastness ratings to be rated against a single set of standard patterns. This method is used when a large number of test specimens have to be tested concurrently.

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*Method for determination of colour fastness of textile materials to daylight (*first revision*).

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2-1960* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes methods for determination of colour fastness of textile materials of all kinds and in all forms to the action of artificial light source, namely, xenon arc lamp

2. PRINCIPLE

2.1 A specimen of the textile material is exposed under prescribed condition along with 8 dyed wool standard patterns to the light from a xenon arc. The fastness is assessed by comparing the change in colour of the specimen with that of the standard patterns

3. SAMPLING

3.1 Lot — The quantity of same kind and form textile material dyed or printed essentially under similar conditions shall constitute a lot

3.2 Sample shall be drawn from the lot so as to be representative of the lot Samples drawn in accordance with the material specification for the coloured textile material or as agreed to between the buyer and the seller shall be held to be representative of the lot

4. PREPARATION OF TEST SPECIMENS

4.1 If the material to be tested is fabric, draw a specimen of area not less than 1 cm × 4 5 cm, from each piece in the *test sample*

4.2 If the material to be tested is yarn, wind enough of the sample closely on a card or lay it parallel and fasten on a card to make a test specimen of the area not less than 1 cm × 4 5 cm taking care that all knots present in the yarn while preparing the test specimen are under the back of the card Draw one such specimen from each piece in the *test sample*

4.3 If the material to be tested is loose fibre, comb and compress enough of the sample into the form of a sheet to make a test specimen of the area not less than 1 cm × 4 5 cm and fasten it on a card. Draw one such specimen from each piece in the *test sample.*

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*Rules for rounding off numerical values (*revised*)

4.4 To facilitate handling, the specimen(s) and strips of standard patterns of similar size may be mounted on a card in some such arrangement as indicated in Fig. 1 or Fig. 2. Each exposed and unexposed area shall not be less than 1 cm × 1 cm.

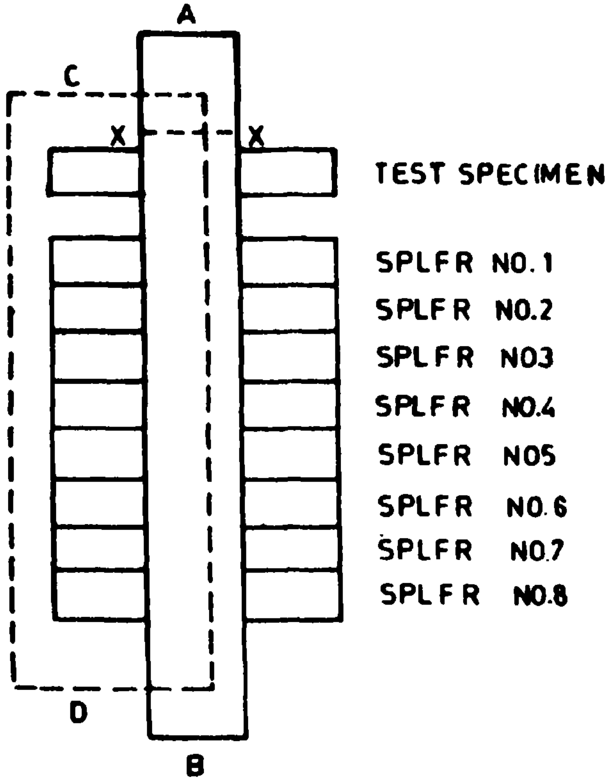

Fig. 1 Mounting of Test Specimen and Standard Patterns for Method 1

4.5 The specimens and the standard patterns should be of equal size and shape in order to avoid errors in assessment due to over-rating the visual contrast between exposed and unexposed parts on the longer specimens as against the narrow standard patterns.

4.6 When testing carpets, the standard patterns shall be arranged in such a way that they are at the same distance from the light source as the surface of the carpet specimens. This can be achieved by underlayed cardboard.

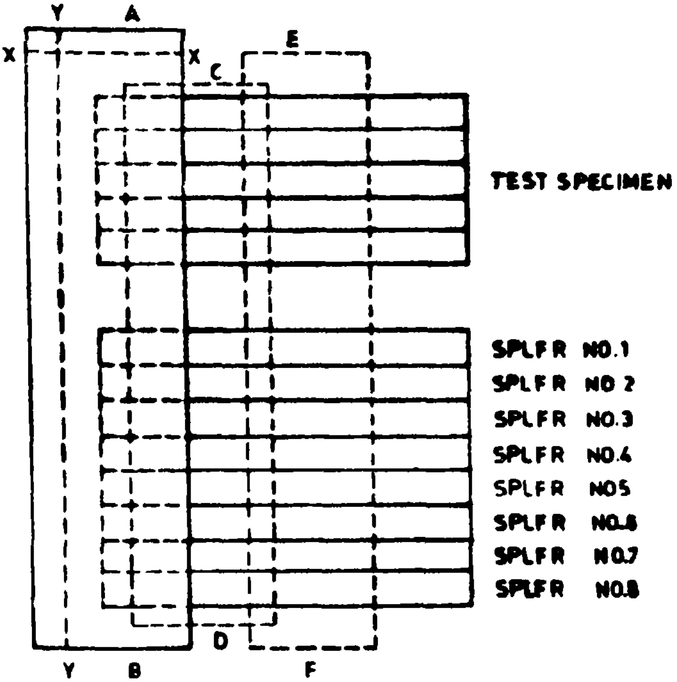

FIG. 2 MOUNTING OF TEST SPECIMENS AND STANDARD PATTERNS FOR METHOD 2

5. STANDARD PATTERNS

5.1 Standard patterns of blue wool cloth ranging in light fastness from rating No. 1 (very low light fastness) to rating No. 8 (very high light fastness) and dyed with the dyes listed in Table 1, shall be used (*see* Note).

NOTE — Sets of standard patterns of light fastness rating No. 1 to 8 may be obtained from the Indian Standards Institution or the British Standards Institution. They are speciallly dyed to match a master set of standard patterns in colour and in fading behaviour. It has been found that, when repeated dyeings for the dyed standard patterns are made, the amount of dye required to match a previous lot is often different from that originally used. The dyeing strengths would, therfore be misleading and they are intentionally omitted from this list.

5.2 The humidity test control of red azoic dyed cotton cloth of an area not less than 1 cm × 4·5 cm shall be used.

NOTE — The humidity test control may be prepared by impregnating bleached mercerized poplin with 4 g/l brenthol AN (C. I. azoic coupling component 4) and developing with 20 g/l brentamine fast scarlet R salt (C. I. azoic diazo component 13). The above humidity test control may be obtained from the Indian Standards Institution.

TABLE 1 DYES FOR STANDARD PATTERNS

(*Clause* 5.1)

FASTNESS RATING No.	DYE-COLOUR INDEX-DESIGNATION*
1	C. I. Acid Blue 104
2	C. I. Acid Blue 109
3	C. I. Acid Blue 83
4	C. I. Acid Blue 121
5	C. I. Acid Blue 47
6	C I. Acid Blue 23
7	C. I. Solubilized Vat Blue 5*
8	C. I. Solubilized Vat Blue 8†

*The Colour Index (third edition) published by the Society of Dyers and Colourists, P. O. Box 244, Perkins House, 83 Gratton Road, Bradford BD1 2JB, West Yorks, United Kingdom.

†The patterns dyed with these dyes should be decatized after dyeing.

6. APPARATUS

6.1 Light Source —Xenon arc lamp of correlated colour temperature of 5 500 to 6 500 K. In case Xenon arc lamp is not available, any other lamp as agreed to between the concerned parties may be used.

6.2 Light Filter — A filter to be placed between the light source and the assembly of test specimen(s) and standard patterns so that the ultraviolet spectrum is steadily reduced. Window glass may be used as filter. The glass used shall have a transmission of at least 90 percent between 380 and 750 nm, falling to zero percent between 310 and 320 nm.

6.3 Opaque Cardboard or Thin Opaque Material — Such as thin sheet aluminium or cardboard covered with aluminium foil or, in the case of pile fabrics, a cover that avoids surface compression.

6.4 Geometric Grey Scale — for assessing the change in colour (*see* IS : 768-1982*).

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*Method for evaluating change in colour (*first revision*).

6.5 Heat Filters — The spectrum of xenon arc contains an appreciable amount of infrared radiations, which should be minimised by heat filters. The temperature conditions (*see* **7.1.1** *and* **7.1.2**) can then be satisfied. The filters should be cleaned regularly to avoid undersirable reduction in light intensity by dirt.

6.6 Black Panel Thermometer (*see* Note 2 under **7.1.2**).

7. EXPOSURE CONDITIONS

7.1 The test specimens are exposed in a well ventilated exposure chamber.

7.1.1 *Normal Conditions*

7.1.1.1 *Moderate effective humidity* — Light fastness of the humidity test control 5, black-panel temperature 45°C *Max.*

7.1.2 *Extreme Conditions* — For testing the sensitivity of specimens to humidity, the following extreme conditions are useful.

a) *Low effective humidity* — Light fastness of the humidity test control 6-7, black-panel temperature 60°C *Max.*

b) *High effective humidity* — Light fastness of the humidity test control 3, black-panel temperature 40°C *Max.*

NOTE 1 — The variation of the light intensity over the area covered by the test specimens and standard patterns should not exceed ± 10 percent of the mean.

NOTE 2 — The black panel thermometer should consist of a metal panel of at least 4·5 cm × 10 cm whose temperature is measured with a thermometer or a thermocouple with its sensitive portion located in good contact with the panel. The side of the panel facing the light source shall be black with a reflectance of less than 5 percent throughout the spectrum reaching the specimen, the side of the panel not facing the light source shall be thermally isolated.

8. PROCEDURE COMMON TO METHODS 1 AND 2

8.1 Humidity Control — Expose partially covered strips of the humidity test control and standard patterns mounted on a card simultaneously until a contrast is produced on the humidity test control equal to grade 4 on the grey scale. Assess the light fastness of the humidity test control and, if necessary, adjust the controls on the lamp to give the selected exposure conditions (*see* **7.1.1** *and* **7.1.2**).

NOTE — Ensure that the strip of humidity test control is mounted uppermost in the sample holder.

8.2 Mounting and Testing of Test Specimens

8.2.1 Expose the specimen(s) and the standard patterns simultaneously for 24 hours per day under the conditions enumerated in **7.1.1** or **7.1.2** in such a manner and for such times as are necessary to evaluate fully the light fastness of each test specimen relative to that of the standard patterns by successively covering both the test specimens and exposed standard patterns throughout the test duration (either by Method 1 or by Method 2).

8.3 Method 1

8.3.1 Mount the test specimen and the standard patterns as shown in Fig. 1 with an opaque cover AB across the middle one-third of the specimen and the standard patterns. Expose the specimen and the standard patterns to artificial light under the conditions enumerated in **7.1.1** or **7.1.2**. Follow the effect of light by lifting the cover AB and inspecting the specimen frequently. When a change in colour of the exposed portion of the specimen can just be perceived, equal to grey scale grade 4-5, note the number of the standard pattern showing a similar change. (This is preliminary assessment of light fastness of the specimen).

8.3.2 Continue to expose the specimen and the standard patterns until the contrast between the exposed and the unexposed portions of the specimen or the standard pattern 7 is equal to grey scale grade 4.

8.3.3 If the standard pattern 7 fades to a contrast equal to grey scale grade 4 before the specimen does, terminate the exposure at this stage. If the specimen fades to a contrast equal to grey scale grade 4 before the standard pattern 7 does, replace the cover AB exactly in the previous position, cover the left hand one-third of the specimen and the standard patterns with another opaque cover (CD in Fig. 1) and continue to expose until the contrast between the fully exposed and unexposed portions of the specimen is equal to grey scale grade 3. At this stage, terminate the exposure.

NOTE — When a test specimen has light fastness rating of 7 or higher, it would require unduly long exposure to produce a contrast equal to grade 3 on the grey scale Moreover, this contrast would be impossible to obtain when the light fastness rating is 8 Assessments in the region 7 to 8 are made, therefore, when the contrast produced on standard pattern 7 is equal to grade 4 on the grey scale. The time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.

8.3.4 Assess the light fastness of the specimen as given in **8.5**.

8.4 Method 2

8.4.1 Mount the test specimens and the standard patterns as shown in Fig. 2. Cover one quarter of the total length of each test specimen and standard pattern with opaque cover AB. Expose the assembly to artificial light under the conditions enumerated in **7.1.1** or **7.1.2** Follow the effect of light by lifting the cover AB periodically and inspecting the standard patterns. When a change in colour of the exposed portion of the standard pattern 3 can just be perceived equal to grey scale grade 4-5, inspect the specimens and assess their preliminary light fastness by comparing any change that has occurred with the changes that have occurred in standard patterns 1, 2 and 3.

8.4.2 Replace the opaque cover AB in exactly the same position and continue to expose until a change in colour of the exposed portion of the standard pattern 4 can just be perceived, equal to grey scale grade 4-5. Place an additional opaque cover CD in the position as shown in Fig. 2, overlapping the first cover AB.

8.4.3 Continue to exposed until a change in colour of the exposed portion of the standard pattern 6 can just be perceived equal to grey scale grade 4-5. Place an opaque cover EF in the position as shown in Fig. 2, the other two covers remaining in position.

8.4.4 Expose the assembly until either:

a) a contrast is produced on standard pattern 7 equal to the contrast illustrated by grade 4 on the grey scale, or

b) a contrast equal to grade 3 on the grey scale, has been produced on the most resistant specimen,

whichever occurs first.

Remove the three covers and conclude the experiment.

8.4.5 Compare the changes in the colour of the specimens and those of the standard patterns and assess the light fastness of each specimen as given in **8.5**.

8.5 Assessment of Light Fastness

8.5.1 The final assessment in numerical ratings is based on contrast equal to grey scale grade 4 and/or grade 3 between exposed and unexposed portions of the specimen (s).

8.5.2 Compare the change in colour of the specimen with the changes which have occurred in the standard patterns under suitable illumination.

The light fastness of the specimen is the number of standard pattern which shows similar changes in colour (visual contrast between the exposed and unexposed portions of the specimen). If the specimen shows change in colour, approximately half way between two standard patterns, the intermediate rating, for example, 3-4 shall be given.

NOTE 1 — In case of doubt in the colour fastness rating as assessed by an observer, the assessment may be made by three observers and the overall rating may be reported accordingly.

NOTE 2 — The term 'change in colour' includes not only true fading, that is, destruction of dyes but also changes in hue, depth, brightness or any combination of these characteristics of colour. If the difference in colour is a change of hue or brightness, this may be indicated by adding abbreviations as follows to the numerical fastness ratings:

Bl = bluer, *Y* = yellower, *D* = duller, and

R = redder, *G* = greener, *Br* = brighter.

If the change in hue is accompanied by change in depth, this may also be indicated as follows:

W = weaker, and *Str* = stronger.

NOTE 3 — In order to avoid a misrating of the light fastness of the specimen due to photochromism, the phototropic specimens shall be allowed to remain in the dark at room temperature for 24 h before the light fastness is assessed.

8.5.3 If the different assessments are obtained at the different degrees of contrast, the light fastness of the specimen is the arithmetic mean of these expressed to the nearest whole or half grade. When three areas are being rated, take the mean of the contrasts closest to grade 4 and 3. Assessments, however, shall be confined to whole or midway ratings only. When the arithmetic mean gives (a quarter or three-quarter rating, the assessment is defined as the next higher half or whole grade).

8.5.4 If the colour of the specimen is more fugitive than that of standard pattern No. 1, a rating of 1 shall be given.

8.5.5 If the light fastness is of rating 4 or higher, assign the test specimen its light fastness rating number but also add within parentheses its preliminary light fastness rating number, if any (*see* **8.3.1**).

Example:

A light fastness rating of 5 (2) indicates that the test specimen changes very slightly in colour, when the standard pattern of light fastness rating No. 2 just begins to fade but that on continuing the exposure, the resistance to light of the test specimen is equal to that of the standard pattern of light fastness rating No. 5.

8.5.6 If specimens larger than the standard patterns were exposed because of certain other requirements a mask of a neutral grey colour midway between the grade 1 and grade 2 of the grey scale (approximately Munsell N5) should be used in assessment which covers the surplus area of the specimens leaving an area equal to that of the standard patterns open for comparative evaluation.

9. REPORT

9.1 Report, individually, the numerical light fastness rating of test specimens.

9.2 If the rating is equal to 4 or higher and the preliminary assessment is 3 or lower, report the latter figure in brackets.

(*Continued from page* 2)

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